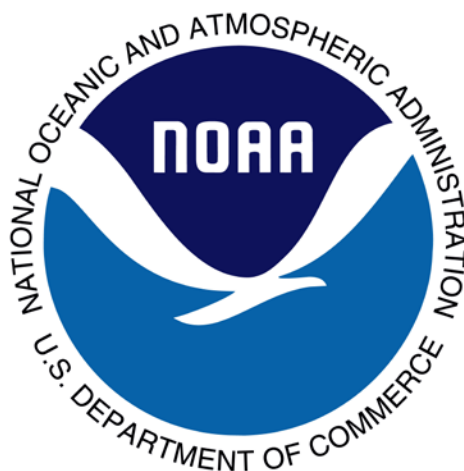


Transport of Oil from BP Whiting Refinery  
Release on 24 MARCH 2014  
Whiting, IN

27 MARCH 2014

Prepared by:  
Chris Barker, PhD  
LCDR Jay Lomnicky, NOAA



Per your request, we have looked at trajectory implications of release from the BP refinery at Whiting, IN on 24 MARCH 2014.

#### BACKGROUND:

Beginning at approximately 1630 March 24, 2014, there was a release of oil near the BP Whiting refinery's cooling water outfall in Whiting, IN (41°40.36'N--87°26.54'W). The initial report was a sheen covering roughly 5,000 sq ft of water. The source has been identified as oily water separator number six. The product has been reported to be a "near full boiling point crude" with an API gravity of 13.6 (SG=0.975)

Boom was deployed to contain the oil on the water surface, and vacuum trucks have been deployed to clean up the contained oil.

Overflights have not indicated any visible oil outside the containment region.

The initial volume estimate has been upgraded, and is currently about 39 bbl. As this is a very heavy oil, NOAA has been asked for an assessment of the potential transport of the oil below the surface.

If any of this initial information is incorrect, please let us know ASAP, as it would affect any trajectory implications.

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#### 1) WEATHER:

Immediately after the release, the winds were from the East, shortly shifting to be primarily from the West until the afternoon of the 26th, when the shifted to be from the South. Winds are currently strong from the South

Tonight: S wind 20 to 25 kt becoming WSW after midnight. Winds could gust as high as 35 kt.

Friday: WNW wind 10 to 20 kt becoming NE in the afternoon.

Friday Night: NNE wind 10 to 15 kt.

Saturday: N wind around 15 kt.

#### 2) CURRENTS:

The currents in Southern Lake Michigan are primarily driven by the winds across the lake. Thus the direction of nearshore currents has switched as the wind changed. The nearshore currents were moving to Southwest for the first two days after the release then reversed in the afternoon of the 26th to be toward the northwest. The currents are expected to continue to the northwest for the next few days.

### 3) TRAJECTORY:

The API gravity of the oil was given as 13.6. This is a very heavy oil, but is still expected to float in fresh water. However, if the oil is not well mixed, and some parts are heavier, some of the oil may not be buoyant.

In addition, any oil that comes in contact with sediments in the water can collect sediment, resulting in oil-sediment particles that can be heavier than water and sink. There are a number of sandy beaches in the region of the release, so there is a potential source of sediment loading of nearshore waters.

Oils with a density this close to the surrounding water can be moved in three distinct modes of transport: floating, suspended, and on the bottom.

#### Floating Oil:

Floating oil tends to spread quickly to form thin sheens, though if the oil is close to its pour point, it can remain in tarballs or tar patties at the surface. In this case, the oil will move with the prevailing currents and is pushed by the near-surface winds. If the oil is fresh and forms a thin sheen, it moves at approximately 3% of the wind speed, but heavy oils and tarballs can move much slower with the wind.

In this case, overflights have not indicated that an observable amount of floating oil has escaped the containment efforts near the outfall. Nevertheless, if there were floating oil, we expect that it would have moved approximately parallel to shore to the southeast, likely beaching on the peninsula to the southeast of the release site.

If any did escape beyond that peninsula, it may have been transported perhaps as far as Burns Harbor. There may have been some shoreline impacts just west of Burns Harbor by the evening of the 26th, but we expect most of it would have stayed just off shore, and it unlikely that an observable amount came ashore.

After the evening of the 26th, the southerly winds would have moved any remaining floating oil offshore, perhaps as far as 15 miles by tomorrow morning. The northerly winds expected for Friday night and Saturday will move any remaining floating oil back toward shore, but with no expected shoreline contact within the forecast period.

#### Suspended Oil:

If the oil, or oil-sediment mixture, is near the density of water it can remain under the water surface, either slowly floating or sinking, but being kept suspended by the turbulence in the water. In this case, the oil would move more or less with the currents, with little wind effect. It would be expect to slowly settle out or rise to the surface when conditions become less turbulent.

In this case, oil suspended in the water column would move with the currents, to the southeast for first two days or so after the release. In this case, it is likely that oil moving with the water

would have been caught up by the peninsula to the east of the release site. Any small amounts of suspended oil that made it past that peninsula might have been transported as far as Ogden Dunes (87°12'W).

After Wednesday evening, we expect further movement would be back to the northwest, continuing that direction for the next few days. But we do not expect it would make it beyond the breakwater at Calumet Harbor. A suspended oil is transported near shore, it could be brought to shore by the surf, resulting in observation tarballs on the beach. It could also accumulate more sediment, and sink to the bottom.

#### Bottom Oil:

Oil that is more dense than water, or has accumulated enough sediment to be that dense, will sink to the bottom near where it was released, or where is accumulated the sediment. Once on the bottom it will tend to remain the same place, unless there is enough turbulent energy to mobilize it. For instance in a river, bottom oil can moved downstream similarly to bed load sediments.

In this region, the currents are likely not strong enough to mobilize the oil, but oil sunk in the nearshore could be mobilized by wave events. It is most likely that any sunken oil would be on the bottom near the release location. However, if it took some time for the oil to accumulate sediment and sink, then it might have moved toward the beach to the east of the release location, and may have settled out in the surf zone of the beach, where it could be periodically re-mobilized by high wave energy events. This might manifest itself as accumulations of tarballs on the beach after storm events.

#### Summary:

**The major challenge with below-surface oil is that is very difficult to observe. Without any observations, we can't make precise assessments of how the oil may have been transported. In this case, if there has been a substantial amount of oil that did not float and be recovered, it would likely have been moved in either a suspended or bottom transport mode, or a combination as it accumulated sediment along the way. In either case, the most likely place for the oil to manifest itself would be a accumulation of tar balls on the beach to the east of the release location, most likely in the stretch closest, but the smaller beach right at the base of the peninsula is another likely collection location.**